IV. *A Letter from Mr.* Stephen Gray *to Dr.* Mortimer, *Secr. R. S. containing a farther Account of his* Experiments *concerning* Electricity.

Charter-Houſe, June *7th,* 1732.

S I R,

SINCE my laſt (N° 422) wherein I gave an Account of my Experiments, ſhewing Water will be attracted by Electrick Bodies, and that it may have an Electrick Vertue communicated to it, ſo as to attract ſolid ones, I have been upon another Enquiry; Whether there might not be a Way found to make this Property of Electrical Attraction more permanent in Bodies? How far I have ſucceeded in this Attempt, will appear by the Experiments I have made on the ſeveral Bodies mentioned in the following Catalogue; and as they were all of them prepared after the ſame manner, excepting Numb. 18 and 19, which ſhall be deſcribed afterwards, a general Deſcription of the Method of preparing and preſerving them in a State of Attraction, may ſuffice.

The Bodies on which the Experiments were made, were Roſin both black and white, Stone-Pitch, Shell or Gum-Lac, Bees-Wax, and Sulphur. I procured three Iron Ladles of ſeveral Sizes, in which I melted theſe Subſtances, making uſe of that which I thought moſt convenient for the Quantity I deſigned to melt. When any of theſe Bodies were melted, they were taken

taken off the Fire, and ſet by in the Ladle to cool and harden; then it was returned to the Fire, where it remained 'till it was melted about the Bottom and Sides of the Ladle, ſo as to be moveable; ſo that by inverting the Ladle, it might be taken out; having the Form of nearly the Section of a Sphere, the Convex Surface, as alſo the Plain one, being naturally (if I may ſo ſay) poliſhed, excepting the Sulphur, which cools without retaining its Poliſh, except when caſt in Glaſs Veſſels, as ſhall be ſhewed hereafter. I ſhall now proceed to the Experiments and Obſervations made on theſe Electrick Bodies.

When any of them were taken out of the Ladle, and their Convex Surface hardened, they would not at firſt attract, 'till the Heat was abated, or 'till they came to a certain Degree of Warmth, and then there was a ſmall Attraction; which Warmth I eſtimated to be nearly that of a Hen's Egg when juſt laid: The Attraction encreaſing ſo, as when cold, to attract at leaſt ten times farther than at firſt.

The manner of preſerving them in a State of Attraction, was by wrapping them up in any thing that would keep them from the external Air; as at firſt for the ſmaller Bodies I uſed white Paper, but for the larger ones white Flannel; but afterwards found that black Worſted Stockings would do as well. Being thus clothed, they were put into a large Fir Box, there to remain 'till I had Occaſion to make uſe of them.

The Cylinder of Sulphur, Numb. 18, was made by melting the Sulphur, and pouring it into a Cylindrick Glaſs Veſſel, which had firſt been heated, to prevent its cracking. When the Sulphur was hardened, it was ſomewhat leſs than the Glaſs; ſo that by inverting the Glaſs, it came out eaſily, and had a poliſhed Surface almoſt as ſmooth as the Glaſs in which it was caſt. The large Cone of Sulphur, Numb. 19, was made after the ſame manner; *viz.* by being caſt in a large Drinking-Glaſs.

I am now to give an Account of the Obſervations made on the ſeveral Bodies mentioned in the Catalogue, but muſt firſt give a Deſcription of the Catalogue. The firſt Column contains the Number, which in a ſmall Piece of Paper is fixed on each of the ſeveral Bodies; the Name of which is given in the ſecond Column, whether they are ſingle or compound Subſtances. The third Column ſhews of what Weight they were of when melted, in Ounces and Drachms of *Averdupois* Weight. In the fourth Column you have the Days of the Month when the Body was melted and received its Form, and conſequently when it firſt began to attract.

I did for thirty Days continue to obſerve every one of theſe Bodies, and found that at the End of the ſaid Time they attracted as vigorouſly as at the firſt or ſecond Day, as they do now at the writing hereof. By the Times mentioned in the Catalogue, being ſubſtracted from any Time after, will be ſhewn how long any of the Bodies have continued their Attractive Vertue; by which it will appear, that ſome of them have not loſt their Attraction for more than four Months: So that we have ſome Reaſon to believe, that we have now diſcovered that there is *a perpetual attractive Power* in all Electrick Bodies, without exciting by either rubbing, beating, *&c.* or any other Attrition. But this will further appear by the Account I am now to give of the two laſt

laſt Bodies mentioned in the Catalogue. The Cone of Sulphur, Numb. 19, that was caſt in a large Drinking-Glaſs, in about two Hours after it was taken out of the Glaſs, attracted, and the Glaſs attracted too, but at a ſmall Diſtance. Next Day the Sulphur was taken out of the Glaſs, and then it attracted ſtrongly, but there was now no perceivable Attraction of the Glaſs. Then the Cone of Sulphur was ſet with its Baſe upon the Lid of the Fir Box, wherein the other Electrick Bodies lay, and the Glaſs whelmed over it. I examined it every Day after, and ſtill found it to attract; but finding the Place not ſo convenient, having Occaſion to look into the Box often, I removed it to the Table that ſtands between the two Windows of my Chamber, where it has continued to this Time, and whenever the Glaſs is taken off, attracts at near as great a Diſtance as the Sulphur that is clothed and ſhut up in the Box abovementioned. And though at firſt there was no Attraction, when the Glaſs was taken off, yet I now find, that in fair Weather the Glaſs alſo attracts, but not at ſo great a Diſtance as the Sulphur, which never fails to attract, let the Wind or Weather be never ſo variable, as do all the other Bodies mentioned in the Catalogue; only in wet Weather the Attractions are not made at ſo great a Diſtance as in fair Weather.

Number 20 is a Cake of Sulphur that was melted; and as the other Bodies have taken the Form of a Convex Section of a Sphere, this, when cold, was laid with its flat Side downwards, on the ſame Table with the Cone of Sulphur: They were both placed ſo near the Wall, as to prevent the Sun ſhining on them. This was, as the Catalogue ſhews, on the 18th of *April*; and though it had no manner of Clothing or Covering, has attracted ever ſince. And in this, as in the other Bodies, the Attraction will be according to the Weather; but when it attracts the ſtrongeſt, it is not more than the tenth Part of what the Cone of Sulphur, that is covered, attracts.

The manner of obſerving theſe Attractions is beſt performed by holding the Attracting Body in one Hand, and a fine white Thread tied to the End of a Stick, in the other; by this means far leſs Degrees of Attraction will be perceived, than by making uſe of Leaf-Braſs. When the Thread is held at the utmoſt Diſtance, it may be attracted; the Motion of it is at firſt very ſlow, but ſtill accelerating as it approaches nearer to the attracting Body.

I am now on the Subject of permanent Attraction in Glaſs, then in the other Bodies, but have not yet compleated thoſe Experiments, meeting with more Interruption by the Weather.

With a ſmall Hand Air-Pump that was lent me by a Friend, I have made Experiments on ſeveral Bodies, and find that they will attract *in vacuo*; and that at very nearly the ſame Diſtance as *in pleno*, provided that the Experiment be made in the ſame Receiver filled with Air; as will appear by the following Experiments.

There was taken a hollow Glaſs Sphere, of ſomewhat more than 2 ½ Inches Diameter, being firſt excited. It was ſuſpended by a Loop of Silk that went through a ſmall Cork, with which the Hole in the Glaſs Ball, by which it was blown, was ſtopped, and by the Loop ſuſpended on a ſmall Hook that was ſkrewed on to the Braſs Wire that came through the

the Collar of Leather in the Braſs-Plate that covered the Top of the open Receiver; as in the Experiment of letting fall the Guinea and Feather *in vacuo*. Then the Ball was drawn up to the Top of the Receiver, and the Top of the ſmall Stand, covered with Paper, was laid on the wet Leather on the Plate of the Pump, and Leaf-Braſs laid on the ſame. Then the Air was exhauſted, when the Glaſs Ball was let down to about an Inch, or ſomewhat more, towards the Pieces of Leaf-Braſs: Many of them were attracted by it. Then the Air was let into the Receiver, and the Leaf-Braſs laid on the Stand, the Ball being, as before, ſuſpended, was let down to about the ſame Diſtance from the Leaf-Braſs as before, and there ſeemed to be very little Difference in the Attraction.

I have made the ſame Experiments with Sulphur, Shell-Lac, Roſin, and white Bees-Wax. Theſe would be attracted to the Height of an Inch and a half by Eſtimation; and when the Experiment was made with the Receiver full of Air, there was very little, if any Difference in the Height of the Attraction, when there was the ſame Time ſpent before the Attraction was begun *in pleno*, as there was required to exhauſt the Receiver.

A CATALOGUE of the ſeveral Electrick Bodies *mentioned in the foregoing Diſcourſe.*

N°	Names of the ſeveral Bodies.	Weight.		Month.	Days.
		℥	ʒ		
1	Fine black Roſin —— ——	2	0	*January*	31
2	Stone Pitch and black Roſin	2	2	*January*	31
3	Fine Roſin and Bees-Wax	2	1	*February*	1
4	Stone Pitch —— ——	1	7	*February*	1
5	Stone Sulphur —— ——	3	6	*February*	4
6	Shell-lac —— ——	10	0	*February*	10
7	Fine black Roſin —— ——	10	4	*February*	11
8	Bees-Wax and Roſin ——	9	0	*February*	12
9	Roſin 4, and Gum-lac 1 *part*	10	0	*February*	12
10	Sulphur —— ——	18	0	*February*	15
11	Stone Pitch —— ——	10	12	*February*	16
12	Black Roſin —— ——	23	0	*February*	23
13	White Roſin —— ——	7	12	*February*	25
14	Gum-lac —— ——	11	14	*February*	26
15	Gum-lac and black Roſin *ana*	9	12	*February*	26
16	Gum-lac 4 *parts*, Roſin 1 *pt.*	17	8	*February*	28
17	Shell-lac, fine black Roſin *ana*	28	4	*March*	2
18	A Cylinder of Stone Sulphur	19	4	*March*	20
19	A large Cone of Stone Sulphur	30	0	*March*	29
20	A Cake of Sulphur —— ——	11	4	*April*	29

S I R,

Be pleaſed to communicate theſe to the *Royal Society*, to whom I hope they will be no leſs acceptable than ſome of my former Diſcoveries from me, who am,

S I R,

Theirs, and your moſt Obedient Servant,

Stephen Gray.